An Impeccable Resolver for Transport Crunch

Creating a secure and accident free environment

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Abstract- This paper is an innovative idea which explores on a way to create an intelligent traffic system with smart vehicles to reduce the number of accidents efficiently. We also propose an intelligent way of identifying traffic patterns and choosing a smarter way for traffic navigation thereby reducing amount of traffic in the roads. The major causes of accidents are identified as consumption of alcohol, negligence and lack of awareness. These problems are individually addressed and the solutions for all these problems are integrated using a PIC 18F4550 microcontroller. Thus a single system is used for reducing traffic jams, accidents, traffic violations etc. It also provides us with a basic database structure for a licensed driver. This circuit uses a breath analyzer, IR sensors, GPS modem, GSM modem circuits and PIC 18F4550 to integrate all these devices to provide an intelligent and competent way for detecting accidents, rules violation etc. Also it is physically designed so that it can be accommodated in any four wheeler vehicle.

Keywords- PIC 18F4550, comparator, GSM modem, GPS modem, IR sensor.

I. INTRODUCTION

This paper enunciates the integration of various features that can be used to make a smart vehicle and an intelligent traffic system. The main aim of this paper is to reduce the number of accidents, increase the security and reduce the traffic present in a road.

A. Accidents

The main causes of accidents are

1. Tiredness of the driver
2. Over-speeding
3. Drunk and Driving

In a nutshell we can summarize all these causes as flouting of general traffic rules. Our aim is to reduce the number of accidents by using

1. Breath analyzer
2. Speed Detector
3. Driver Awakening System
4. Collision Avoidance System.

B. Post Accident

Once an accident occurs one has to know the exact location of the accident. Emergency services have to be intimated and their close acquaintances have to be informed immediately.

C. Traffic Jams

Usually people do not use alternate routes to go to a particular place because they are well versed in going by the main road. This causes a strain on the traffic. By using an effective traffic control system we can avoid this problem.

D. Security

The cars must be secured properly as car thefts have increased 255% in the last ten years [7]. One of the major problems in controlling car theft is that we do not know the precise moment when it is stolen from the location where it has been parked. Thus we provide a system to overcome this disadvantage.

This overall improves the efficiency of the entire traffic and communication system. Our aim is achieved through the following parts of the circuit.

1. Collision Detection
2. Automatic Traffic Guidance
3. Vehicle tracking System
4. Vehicle Security System
5. Accident triggered Alarm System
6. Traffic Violation Detection System
7. Driver awakening system
8. Traffic Light jumping system

The purpose of this work is to integrate all these systems so that one can have an effective traffic system. The overall work has to be visualized in two measures:

1. Client side
2. Data base side

Implementation of this work has to be done in these two phases.

II. CLIENT SIDE

The client side of the system contains basic hardware for implementing the smart traffic system. It has various components required for the vehicular parts. The system can be inbuilt. But as there are large number of vehicles on our roads these client side equipments are manufactured in such a way that they can be installed in any vehicle. These include various parts of the work such as

1. Breathe analyzer
2. Microcontroller
3. Cell phone
4. GPS modem

5. Sensors

All these and the circuits for their appropriate operations are installed in the vehicle.

III. Database Side

This part of the traffic system includes a server which has to be installed in a traffic monitoring or traffic law enforcement office. The server is installed with software like Oracle or any other DBMS system as back end. This server acts as the database for each and every driver present in the area. It presents the enforcer with all the details regarding all the violations that the driver has committed. Whenever a violation is done by a vehicle it is registered by the system to its vehicle number. Then proper action and enquiry is done on the violation and the rule violation is recorded with the mainframe server which has details of all the drivers with a registered license. This method will effectively curb violations as the law enforcer can keep track of all the records of repeated offenders and can take severe action against them.

IV. Major Components Used

E. PIC micro Controller

F. GSM modem

G. GPS Modem

H. Required Gates and logic circuits

V. Breath analyzer

A simple breath analyzer circuit is used for detecting the alcohol content present in our body. There is a limitation of the consumption of alcohol while driving and it differs for different areas. In this work our aim is to use the breath analyzer to detect the amount of alcohol present in the body of the driver and if the limit exceeds certain value, the law enforcement system and a family member has to be informed. This is done by our system [15]. Here the output of the breath analyzer is given as input to the microcontroller which is connected to a cell phone. This cell phone automatically messages to the programmed numbers.

Breath analyzer contains a simple silicon bead sensor whose surface resistance changes with change in alcohol level. The device is calibrated for the intoxication level and is given to a comparator the output of the comparator is given as input to the microcontroller which in turn messages through a cell phone for the DBMS.

$$R = A * [C] b \quad (1)$$

Where

R = resistance

A = constant

[C] = concentration of gas

b = constant

This is the equation for a silicon bead sensor where the surface of the resistance varies in accordance with the presence of alcohol content [3]. This output from breath analyzer is taken as input and compared with a reference voltage set manually. This output is then taken into a micro controller which is then accessed by the F bus to send a sms through the transmitting Cell phone or GPS modem to the law enforcer, the guardian and the driver stating that he has violated a rule. The DBMS system is also notified and the system keeps track of all the charges of the driver for which he is convicted after an enquiry and adds to his profile.

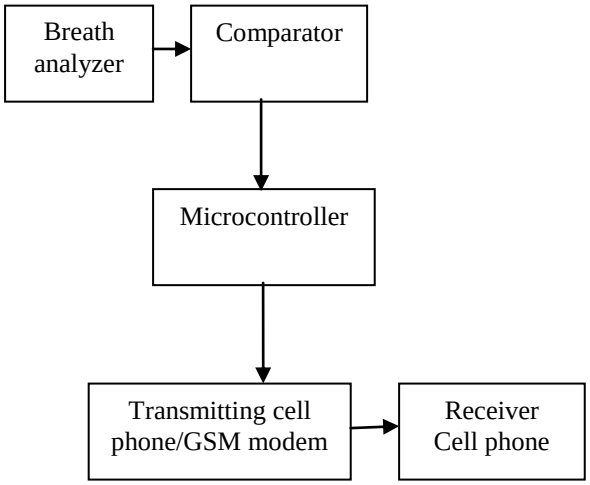

Figure 1. Breath analyzer

VI. Speed Detector

In this system our DBMS acts as the main source of communication. Every time when a car enters a new zone it comes under the influence of that particular mobile tower. The microcontroller receives the data through the GPS modem and each route is assigned with a speed limit. The comparator considers this received speed value as the base value. It acts as the reference value to the comparator where the other input is the speed of the vehicle. When the output of this circuit is high i.e. when the speed is violated as in the previous case a message is sent to law enforcer, a kith or kin of the owner of the vehicle and the driver thereby storing the infringement in his profile. The man who takes the responsibility of the driver i.e. the family member is called an Autonomer and will be referred as such henceforth. The group of these three people is referred as GROUP A.

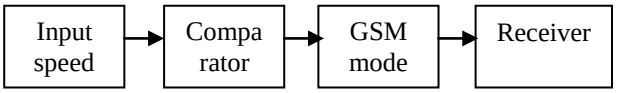

Figure 2. Speed Detector

VII. Lane Changing System

Two IR sensors are placed near the wheels of the vehicle one in the left side and the other near the right side of the vehicle. While passing through highways or any other busy roads with large number of lanes, by the GPS system present in the vehicle the vehicle switches the particular part of the circuit ON. When the circuit is switched on it monitors the entire activity of the vehicle while lane changing. When the vehicle is going straight the output of IR sensor and the output of the indicator is LOW hence there is no problem. Once the vehicle has to change lane the vehicle has to switch its indicator ON. The roads with multiple lanes usually consist of multiple white divider lines throughout the road. Hence when the car turns right or left, the appropriate indicator is switched on and the car passes over the white line to its desired lane. When the indicator is not switched ON, the Lane changing circuit gives a high

output which is transferred to the GSM modem that tells the DBMS and group A stating a Lane changing violation has taken place.

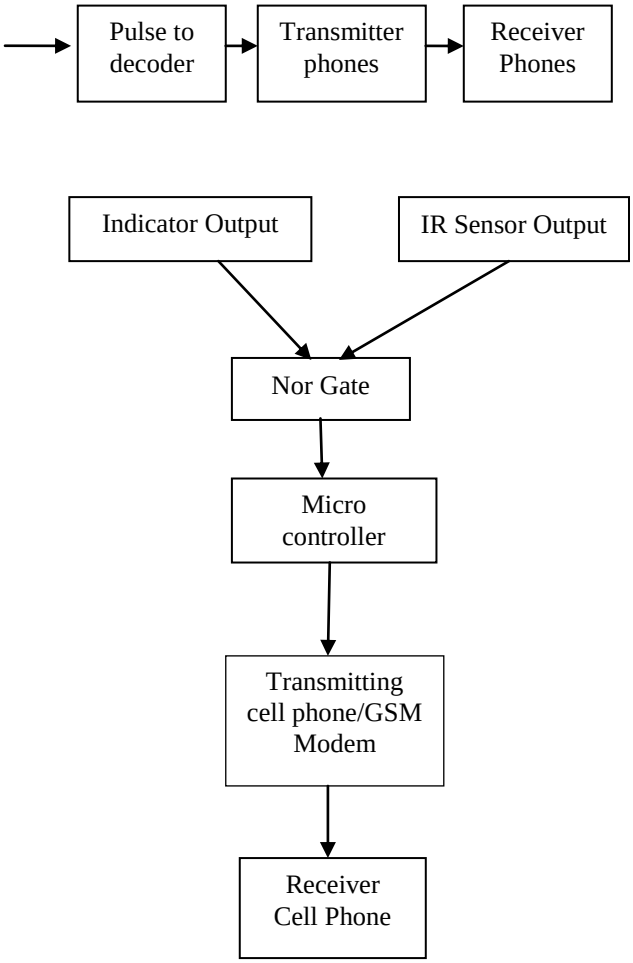

Figure 3. Lane Changing System

VIII. DRIVER AWAKENING SYSTEM

This system can be easily implemented with a web camera interface. The web cameras can have special software like SMARTCAM or PROCAM installed with them. Thus the camera is mainly focused on the eyelids of the person. When the eyes of the driver is closed for a long duration say ten seconds the web camera detects the anomaly and sends the corresponding signals to the alarm. The driver is immediately woken up by the sounds of the alarm. Also integrating this system with the collision detection system brakes are applied gradually and any unfortunate incident may be avoided.

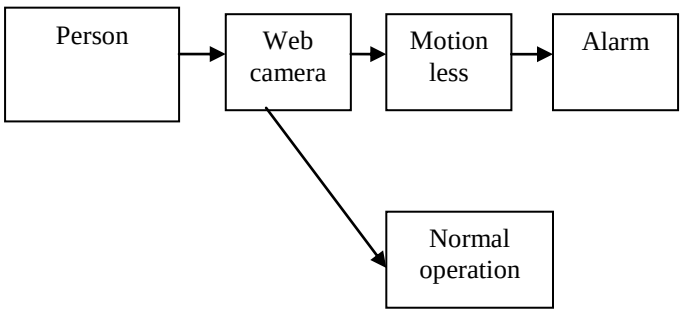

Figure 4. Driver Awakening System

IX. ACCIDENT TRIGGERED GPS MODEM LOCATION SYSTEM & SECURITY SYSTEM

A. Security System

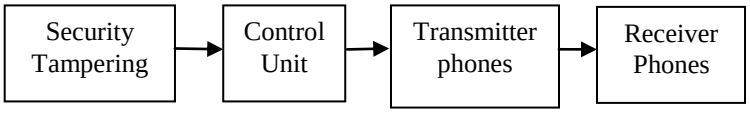

Figure 5. Security System

Before starting the car the driver is asked to enter a password in a touch pad which is interfaced with our PIC microcontroller. The software in the system checks if the password is right if not the system gives three chances. If the driver fails to type the password correctly but starts the engine then the GSM modem sends a signal alerting the group A [1]. If GSM/GPS system is removed from the circuit then the group A is again alerted as it is considered as code RED which will be explained in further sections.

B. Accident Alarm System

When a vehicle collides with another car or an obstacle the car maybe immobilized totally or it might be an accident of minor proportions. In the latter case no alarm or panic is required. Whenever a car is met with an accident a timer is started. If the car is not mobilized in a matter of one minute then the Microcontroller is biased to take the decision that the car is met with a major accident.

1) Code Green:

If the car collides and after sometime maybe one minute the car is moved from that place after the driver types his password then the situation is considered to be “CODE GREEN”. In this case the system considers the scenario to be minor accident and no further action takes place.

2) Code Blue:

If the car collides with the obstacle and the vehicle remains unmoved for sometime i.e. 1 minute then the scenario is considered to be a major accident and GROUP A and an ambulance is notified with the location of the accident. This is called as CODE BLUE.

3) Code RED:

In this situation the GSM network is lost from the telecommunication network this can happen in two cases one if the GSM system is removed from the vehicle or if the system is crashed due to a fatal accident. In both cases the situation is considered as the potentially dangerous scenario and group A along with the ambulance is notified.

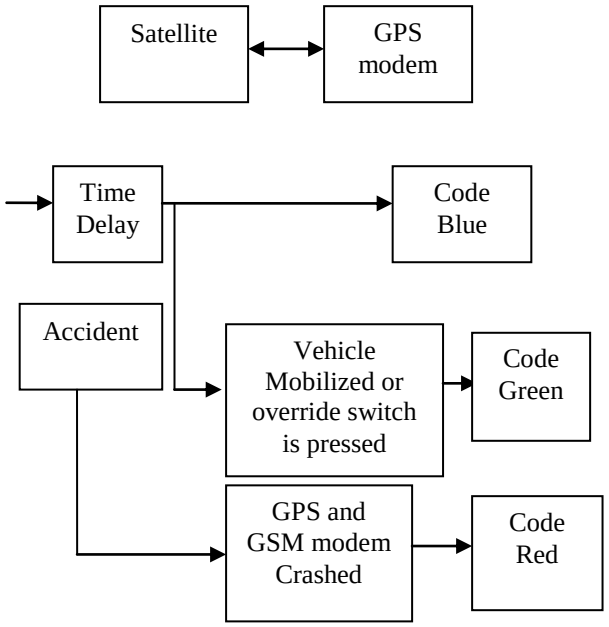

Figure 6. Accident Alarm System

X. Traffic Light Violation Detection System

The stop line of the cross roads are ably supported by an IR sensor and receiver circuit or by using an LIDAR senor. Here light is allowed to pass freely in the absence of any vehicle. The circuit is turned on when the signal changes to red. All the vehicles should stop before the stop line. When a vehicle crosses the stop line even though the signal is red there is change in the output of the circuit. This change is immediately fed-back to the system and a camera which is strategically placed immediately takes a photograph of the vehicle. This image is then identified by the law enforcement personnel and Group A is informed about the infringement. As in the case of above mentioned circuit the infringement is made as a permanent record as the driver's traffic offense.

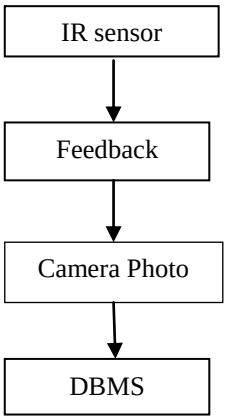

Figure 7. Traffic Light violation detection system

XI. Automatic Traffic Guidance System

A GPS based system where the location of source and destination is given as variable data to the computer. This accesses the main frame Database system where similar requests are received. The DBMS then sends the appropriate routes using the Dijikstra's algorithm. When the traffic density exceeds a limit the DBMS is programmed to give alternate vehicle routes to the next vehicle requesting for access.

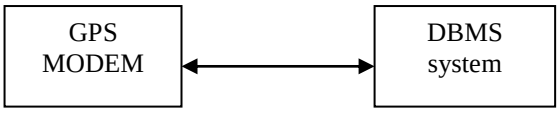

Figure 8. Automatic Traffic Guidance System

XII. Obstacle Detection System

In the obstacle detection system the sensor used in this work is IR sensor. For advanced works smart sensors or LIDR may be used. But the advantage of using an IR sensor is that it is basically very simple circuit to execute. The basic principle involved is similar to that of a line follower robot except that whenever the IR sensor senses a block or an obstacle then the sensor must stop the vehicle after a critical distance by the application of brakes [10]. This type of system can be used in electrical braking systems. But the problem with our model of cars is that every system has a mechanical braking system only. So in order to apply this system to all cars present we will introduce a modification to the cars [4].

A. Modification:

The lower surface of the brake pedal is mounted with a permanent thin layer magnet with high magnetic field intensity. The surface of the car below the brake pedal incorporated with a thin layer of electromagnetic material which has very high magnetic flux density but has very low hysteresis loop.

B. Need and importance:

The working of the system is very simple. The front end of the car is most prone zone and dangerous zone in accidents as high fatality results in the driver zone as the collision is faced head on by him. People tend to miss small objects present below the field of vision which might act as an obstacle in accidents. Moreover when cars are driven negligently people tend to overlook the small obstacles present before them. This results in accidents [2].

C. Working:

To avoid this Obstacle detection system may be used. Here the IR sensor may be connected to the bonnet of the vehicle. The size and number of IR sensors depends upon the sensitivity, accuracy and precision of the system. When an obstacle is detected the output of IR sensor is made high. This in turn provides a high signal to the electromagnetic surface present in the bottom of the vehicle. This attracts the metallic magnetic surface present in the bottom of the brake pedal thereby applying manual brakes. The intensity of electrical signals is increased gradually so that the vehicle does not skid [6].

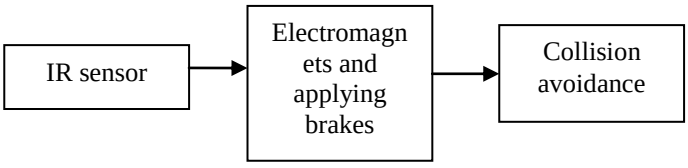

Figure 9. Obstacle Detection System

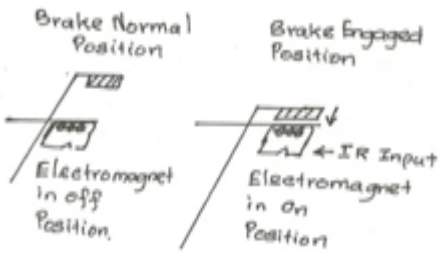

Figure 10. Electromagnetic Bonnet Brakes

XIII. THE INTERFACE

The system which basically acts as the brain of our Intelligent Traffic Control System is the interfacing unit which converts the input signals that are sent to the micro controller. This interfacing circuit consists of PIC 184F5540 [11]. A line converter MAX232 is employed to convert the RS232 logic data of GSM Module to TTL logic so that it can be processed by the microcontroller in micro controllers like 8085. In this work, instead of RS232 logic data, TTL logic output has been taken and thus PIC18F4550 has been directly connected with GSM Modem without any line converter in between. The following diagram shows the TTL input and output of GSM modem used [15].

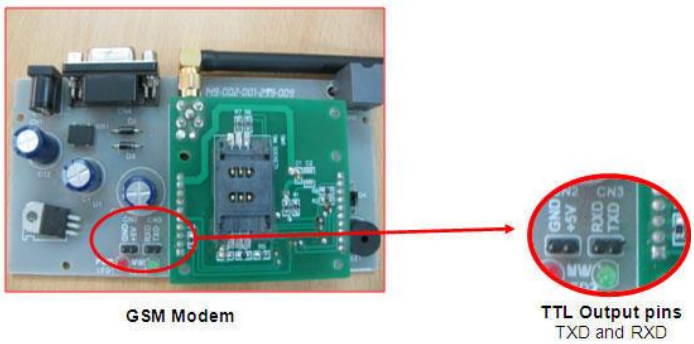

Figure 11. GSM Modem and its Pins

Thus this part of the circuit is then connected to the GSM modem. Our aim is to send Different messages to GROUP-A people depending upon the violation that has been done. The PIC microcontroller used has the following PIN configuration [14].

PROGRAM:

```
//Program to interface GSM Modem with PIC18F4550 Microcontroller
//Choice 4: Send a text message to a mobile number
#define FREQ 12000000
#define baud 9600
#define spbrg_value (((FREQ/64)/baud)-1)
#define rs LATA.F0
#define rw LATA.F1
#define en LATA.F2
void gsm_cmd(unsigned char *);
void output(void);
unsigned char value=0;
int i=0,j,k,temp,flag,choice;
unsigned char *starting_text="Enter choice=";
unsigned char *dial_text="Dialing...";
unsigned char *at_cmd="AT";
unsigned char *imei_cmd="AT+GSN";
unsigned char *call_cmd="ATD9xxxxxxxxx;";// Provide a 10-Digit Mobile Number
unsigned char *sms_format="AT+CMGF=1";
unsigned char *sms_write="AT+CMGS=\"xxxxxxxxxx\"";// 10-Digit Mobile Number
unsigned char *sms="Hello";
unsigned char *sms_report="SMS Sent...";
unsigned char sms_terminate=0x1A;
unsigned char enter=0x0D;
unsigned char *data;
void main()
{
        TRISB=0;        // Set Port B as output port
        LATB=0;
        TRISA=0;
        LATA=0;
        TRISD=0xFF;
        LATD=0;
        SPBRG=spbrg_value; // Fill SPBRG register to set the baud rate
        RCSTA.SPEN=1;// To activate serial port (Tx and Rx pins)
        TXSTA.TXEN=1;// Activate Transmissiom
        RCSTA.CREN=1;// Activate Reception
        PIE1.RCIE=1;// Enable Reception interrupt
        INTCON.GIE=1;// Enable Global interrupt
        INTCON.PEIE=1;// Enable Peripheral interrupt
        lcd_ini();
        while(1)
        {
                k=0;
                lcdcmd(0x80);
                while(starting_text[k]!='\0')
                {
                        lcddata(starting_text[k]);
                        k++;
                }
                //Check inputs
if (PORTD.33==1)// for Code Red
{
                        gsm_cmd("CODE RED");
                        output();
                        Delay_ms(1000);
gsm_cmd(sms_write1);//For the owner
                        output();
                        Delay_ms(1000);
gsm_cmd(sms_write2);//For the Law enforcer
                        output();
                        Delay_ms(1000);
gsm_cmd(sms_write3);//FOR the moral autonomer
                        output();
                        Delay_ms(1000);

gsm_cmd(sms);
                        output();
                        tx_data(0x1A);
                        Delay_ms(1000);
}
if (PORTD.34==1)// for Alcohol
```

```
{
                        gsm_cmd("Alcohol Abuse");
                        output();
                        Delay_ms(1000);
gsm_cmd(sms_write1);//For the owner
                        output();
                        Delay_ms(1000);
gsm_cmd(sms_write2);//For the Law enforcer
                        output();
                        Delay_ms(1000);
gsm_cmd(sms_write3);//FOR the moral autonomer
                        output();
                        Delay_ms(1000);

gsm_cmd(sms);
                        output();
                        tx_data(0x1A);
                        Delay_ms(1000);
}
if(PORTD.35==1)// for Speed
{
                        gsm_cmd("Exceed speed limit");
                        output();
                        Delay_ms(1000);
gsm_cmd(sms_write1);//For the owner
                        output();
                        Delay_ms(1000);
gsm_cmd(sms_write2);//For the Law enforcer
                        output();
                        Delay_ms(1000);
gsm_cmd(sms_write3);//FOR the moral autonomer
                        output();
                        Delay_ms(1000);

gsm_cmd(sms);
                        output();
                        tx_data(0x1A);
                        Delay_ms(1000);
}
if(PORTD.36==1)// for Lane Changing
{
                        gsm_cmd("No indicators while lane
changing");
                        output();
                        Delay_ms(1000);
gsm_cmd(sms_write1);//For the owner
                        output();
                        Delay_ms(1000);
gsm_cmd(sms_write2);//For the Law enforcer
                        output();
                        Delay_ms(1000);
gsm_cmd(sms_write3);//FOR the moral autonomer
                        output();
                        Delay_ms(1000);

gsm_cmd(sms);
                        output();
                        tx_data(0x1A);
                        Delay_ms(1000);
}
void gsm_cmd(unsigned char *string) //For accidents
{
        i=0;j=0;
        while(string[i]!='\0')
        {
                temp=0;
                if(string[i]==0x5C)// Not to send '\' character
                i++;
                tx_data(string[i]);// Send by serial
communication
                i++;
                while(temp!=1);
        }
        temp=0;
        tx_data(enter);// Send ASCII code for 'Enter' key
        while(temp!=1);
}
void tx_data(unsigned char serial_data)// Transmit data
function
{
        TXREG=serial_data;
        while(PIR1.TXIF==0);
}

void interrupt()
{
        data[j]=RCREG;// Store the data into array when
Reception interrupt occurs
        value=RCREG;
        j++;
        temp=1;
}
```

PIN DIAGRAM:

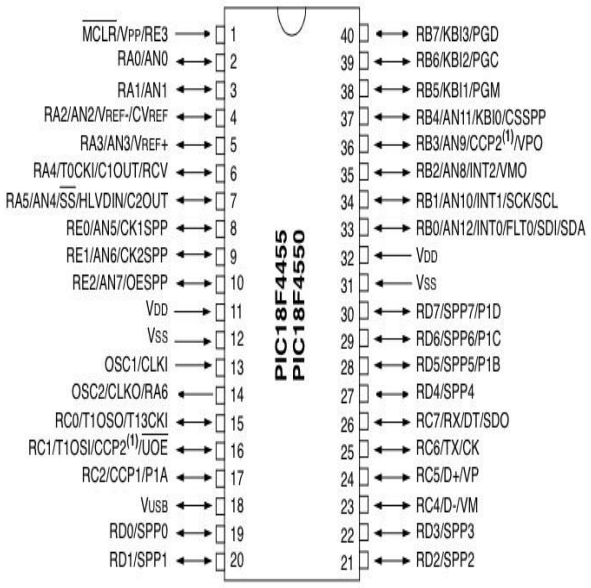

Figure 12. PIC 184F550

We can see that there are 8 input pins and 8 output pins [8]. Hence after interfacing the necessary parts of the circuit we can send sms based on the required conditions to the desired numbers. For example if the car is being stolen without giving a password the output from the security part of the circuit is given to PIN 33. When 33 is high pin 19 is made HIGH this allows a

corresponding program to be developed in such a way that the message "CAR STOLEN" is sent to GROUP A along with the details of its last known whereabouts. Thus this part of the circuit is used for integrating the entire circuit [13].

The basic interfacing of the circuit with GSM module is shown as follows.

TABLE I. INPUT AND ITS CORRESPONDING OUTPUT

Input Pin	Output Pin	Function
33	19	Car Stealing/Code Red
34	20	High Alcohol intoxication
35	21	Speed Violation
36	22	Lane Violation
37	27	Traffic Light Violation
38	28	Automatic Traffic Guidance
39	29	-
40	30	-

The overall circuit can be visualized as follows

Advantages

1. The system is a failsafe system.
2. The efficiency of the system is very high
3. It gives a permanent record of the people's history of driving.
4. It discourages drivers to flout rules as the system allows a family member to know about his loggerheads with law which most people will not prefer.
5. It provides an extensive way for reducing car theft.
6. It improves the overall ambience of driving.
7. It can be attached in cars which are already present.
8. It can be safely manufactured in new cars.
9. It integrates many widespread traffic improvement systems.
10. The future improvements of the work are fantastic and fascinating.

Disadvantages:

1. The implementation cost is very high.
2. Though the cost of maintenance of the client system is very cheap the maintenance cost of the DBMS system is large.

XIV. CONCLUSION

This Intelligent System for traffic system can be considered as the most efficient system for curbing major problems like traffic jams, accidents, traffic rules violation etc. It is my humble opinion that if this system is implemented the untoward incidents that happens in the transportation and communication system will be avoided in the future. Transportation THE BLOODLINE for improvement will be provided with new LEASE OF OXYGEN thereby causing an overall makeover in the traffic system.

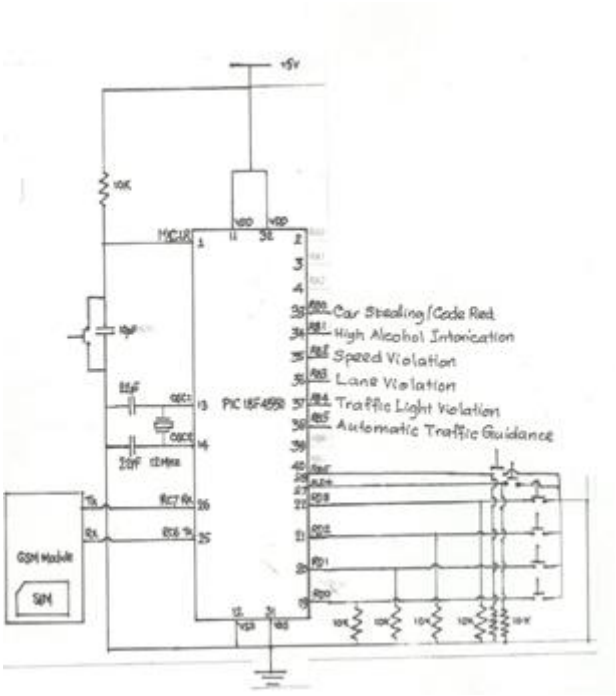

Figure 13. Interfaced diagram

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